

with the conduit 9 positioned between the ion source 3 and the gas source 7. The conduit 9 operates to carry the heated gas from the gas source 7 to the collecting capillary end 20. The method of the present invention produces enhanced analyte ions for ease of detection in the mass spectrometer 1. The method comprises heating analyte ions located in the ion or ionization region 15 adjacent to the collecting capillary 5 with a directed gas to make them more easily detectable by the detector 11. Gas is produced by the gas source 7, directed through the channels 38 and the small gap 36. From there the gas is carried into an annular space 42 defined between the conduit 9 and the collecting capillary 5. The heated gas then contacts the optional centering device 40 (not shown in Fig. 8). The centering device 40 is disposed between the collecting capillary 5 and the conduit 9 and shaped in a way to regulate the flow of gas to the ionization region 15. Gas flows out of the conduit 9 into the ionization region 15 adjacent to the collecting capillary end 20. The analyte ions in the ionization region 15 are heated by the gas that is directed into this region. Analyte ions that are then enhanced are collected by the collecting capillary 5, carried to the main capillary 18 and then sent to the detector 11. It should be noted that after heat has been added to the analyte ions adjacent to the source, the detection limits and signal quality improve dramatically. This specific result based on heating the analyte ions adjacent to the source is quite unexpected. For instance, since no solvent is used with AP-MALDI and MALDI ion sources and mass spectrometers, desolvation or application of a gas to heat the ions would not be expected to be effective in enhancing the number or intensity of ions detected in matrix based ion sources and mass spectrometers. However, it is believed that large ion clusters are broken down to produce bare analyte ions that improve detection limits and signal quality, as referred to above.

IN THE CLAIMS:

Without prejudice, please cancel claim 48 and please amend the claims as follows:

1. (Amended) A conduit for providing a heated gas flow to enhance analyte ions produced by a matrix based ion source and discharged to an ion region adjacent to a collecting capillary.

11. (Amended) A mass spectrometer comprising:

- (a) a matrix based ion source for producing and discharging analyte ions to an ion region;
- (b) a collecting capillary downstream from both said matrix based ion source and said ion region for receiving said analyte ions produced and discharged from said ion source to said ion region;
- (c) a gas source for providing a gas;
- (d) a conduit for conducting said gas from said gas source toward said ion region and providing ion enhancement to said analyte ions located in said ion region

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- (e) before said analyte ions enter said collecting capillary, and a detector downstream from said collecting capillary for detecting said analyte ions enhanced and received by said collecting capillary, wherein the detector includes or is coupled to a mass analyzer.
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A7 28. (Amended) The mass spectrometer of claim 11, wherein the volume of said ion region is from 1-5 mm³.

A8 36. (Amended) A method for detecting analyte ions in a mass spectrometer, comprising:

- (a) heating analyte ions produced from a matrix based ion source with a directed gas to produce enhanced analyte ions; and
- (b) detecting said enhanced analyte ions with a detector, wherein the detector includes or is coupled to a mass analyzer.
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38. (Amended) A method for heating analyte ions for detection in a mass spectrometer, comprising:

directing a heated gas flow through a conduit to an ion region adjacent to a collecting capillary to heat said analyte ions located in the ion region and increase at least one of an intensity and a number of said analyte ions detected by a detector, wherein the detector includes or is coupled to a mass analyzer.

A9 39. (Amended) An apparatus that produces enhanced analyte ions for detection by an ion detector, comprising:

- (a) a matrix based ion source for producing analyte ions;
- (b) an ion detector downstream from said ion source for detecting enhanced analyte;
- (c) an ion enhancement system interposed between said matrix based ion source and said ion detector for enhancing said analyte ions; and
- (d) an ion transport system adjacent to said ion enhancement system for transporting said enhanced analyte ions from said ion enhancement system to said ion detector.

40. (Amended) An apparatus as recited in claim 39, wherein said ion detector includes a mass analyzer.

A10 47. (Amended) A mass spectrometer comprising:

- (a) a matrix based ion source for producing analyte ions;
- (b) an ion detector downstream from said ion source for detecting enhanced

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- (c) analyte ions, the ion detector including or being coupled to a mass analyzer;
 - (d) an ion enhancement system spaced from and interposed between said matrix based ion source and said ion detector for enhancing said analyte ions; and
 - (d) an ion transport system adjacent to said ion enhancement system for transporting enhanced analyte ions from said ion enhancement system to said ion detector.

52. (Amended) A method for detecting analyte ions by a mass spectrometer, comprising:

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- (a) producing analyte ions in a matrix based ion source and discharging said ions to an ion region;
 - (b) enhancing said analyte ions discharged to said ion region with an ion enhancement system; and
 - (c) detecting said enhanced analyte ions with a detector, wherein the detector includes or is coupled to a mass analyzer.

Please add new claims 55 to 59 without prejudice as follows:

55. (New) A mass spectrometer as recited in claim 47, wherein said analyte ions are enhanced by applying a heated gas to contact said analyte ions.

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56. (New) A mass spectrometer as recited in claim 55, wherein said heated gas is in a temperature range of about 60 degrees Celsius to 150 degrees Celsius.

57. (New) A mass spectrometer as recited in claim 55, wherein said heated gas has a flow rate of approximately 2 liters/minute to 15 liters/minute.

58. (New) A mass spectrometer as recited in claim 47, wherein said ion enhancement system includes a conduit, and the conduit is positioned a distance of about 1 mm to 5 mm from the matrix based ion source.

59. (New) A mass spectrometer as recited in claim 47, wherein:

- said analyte ions are enhanced by applying a heated gas to contact said analyte ions;
- said heated gas is in a temperature range of about 60 degrees Celsius to 150 degrees Celsius;
- said heated gas has a flow rate of approximately 2 liters/minute to 15 liters/minute; and
- said ion enhancement system includes a conduit, and the conduit is positioned a